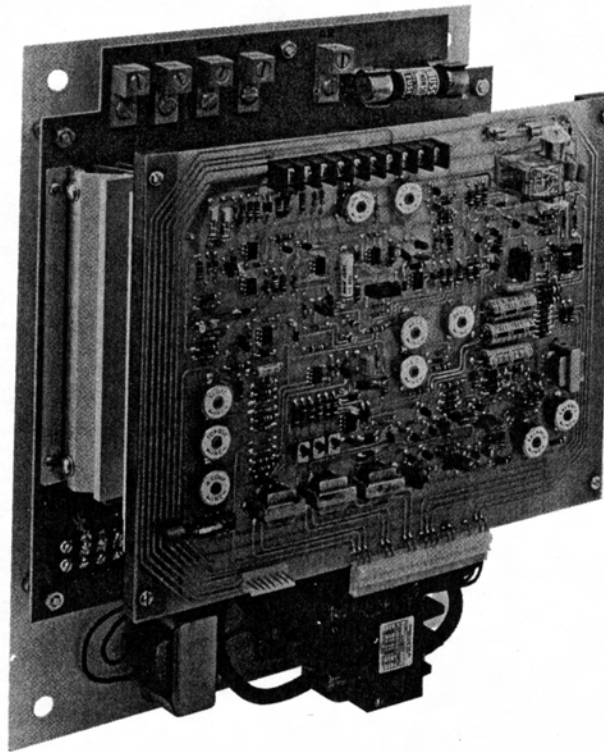


SECO

MODEL L400 INSTRUCTION MANUAL



SECO ELECTRONICS
BOX 697, RT. 4, HWY 29
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Phone: (803) 285-6927

DANA INDUSTRIAL

Seco



Price \$3.00
Bulletin L400-1

1.0 GENERAL DESCRIPTION

SECO ELECTRONICS L400 Series Motor Control provides speed control for DC shunt wound motors from zero to full rated speed of the motor. The L400 series control will operate with any appropriate motor over the horsepower range of 5 HP through 15 HP. A typical system would include the series L400 motor control, drive motor and remote operator's station.

1.1 DRIVE MOTOR

SECO ELECTRONICS supplies DC motors built to Nema standards for general applications and are designed for operation with three phase full wave rectification. Standard motor armature voltage for the L400 series is 240 DC volts at base speed. The motors are available as open dripproof or totally enclosed. These motors are normally supplied with foot mounting bases. When tachometer feedback is required most motors can be supplied with motor mounted tachometers.

1.2 REMOTE STATIONS

SECO remote operator stations are identified as follows:

Part No.	Description
8005	Start-stop push buttons, speed adjust potentiometer
4005-RJ	Start-stop push buttons, speed adjust potentiometer, run-jog selector switch, jog speed adjust (located inside remote station)

1.3 TECHNICAL DATA

Input voltage	208-250 VAC, 50/60 Hz three phase
Armature output voltage	0-240 VDC
Horsepower range	5 through 15
Field Voltages	150/200/240 VDC
Operating temperatures	0° C to 45° C
Speed Range	Infinitely adjustable (see motor specification for motor limitations)
Load regulation	(95% load change) armature feedback mode ±2% of base speed Tachometer feedback mode ±.5% of base speed.
Tachometer voltage	12.25 VDC at base speed, other voltages optional.
Torque adjust	0-150% of full load, adjustable
Torque slope control	Refer to Figure 1.1
Acceleration rate	Adjustable over the range of 3 to 40 seconds, linear within the torque capability of the drive.
Deceleration rate	Adjustable over the range of 3 to 40 seconds linear. (Friction load, low Inertia)
IR Compensation	Adjustable
Max speed	30% to 110% of base speed
Minimum speed	0 to 30% of base speed
Control voltage to operator's station	120 VAC 60Hz, fused 2A, Isolated

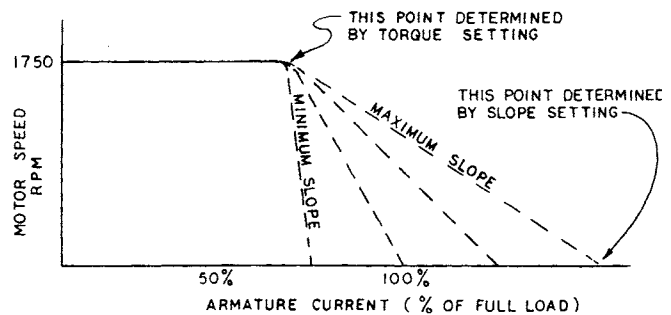


Figure 1.1

Overload protection:

1. (IEOT) Instantaneous Electronics Over-Current Trip: set to approximately 50% of SCR one cycle rating, trip within one cycle.
2. Armature: Fused for 15 HP.

Transient Protection:

1. AC Line: Mov suppressors, RC suppressors
2. Armature: Mov suppressors, RC suppressors

2.0 INSTALLATION PROCEDURES

2.1 MOTOR INSTALLATION

Before installing the motor, read the motor nameplate. Check the HP rating, armature voltage, and field voltage data. Make sure these ratings agree with the motor control ratings. If the motor was not supplied by SECO, be sure it was designed for SCR application.

NOTE: If the motor has not been designed for SCR power supplies, derate the motor at least 30% to 50% (consult with motor manufacturer for exact derating.)

The L400 motor control can be used with motors requiring 150V, 200V or 240V field voltage simply by connecting to the proper pair of terminals. (see connection diagrams)

SECO supplied DC shunt motors are available for base mounting or with a C face. The drive motor may be connected to the load through a gear reducer, belt or by direct coupling. When a motor is coupled through a gear reducer, make certain that C flanges are mated properly. Connect the gear reducer according to the manufacturer's instructions.

If the motor is coupled to the load by belting, it is important that the sheaves be in line. Check belt tightness. A belt that is too loose will result in excessive slippage.

Direct coupling is best accomplished by using a flexible coupling. A proper coupling will extend the life of the bearings in the motor.

NOTE: A properly connected coupled load does not exert forces on the motor shaft in any direction.

Refer to the connection diagrams or schematics furnished with the motor before connecting the motor to the control. P1 and P2 leads are usually for built-in motor thermostats. S1 and S2 leads are for the stabilized shunt winding.

As armature current increases, the winding acts to aid the field. This winding is connected in series with the motor armature. If these leads are reversed, instability will result as the motor load is increased.

On contactor reversing applications the S1 and S2 winding must be wired on the power supply side of the reversing contactors.

Motors with additional field leads marked F3 and F4 are for special field connections. Check manufacturer supplied connection diagrams before operation.

2.2 DIRECTION OF MOTOR ROTATION

The standard direction of the motor rotation is counter-clockwise (CCW) looking at the end opposite the drive shaft. SECO supplied motors with A1, A2, F1, and F2 connected as shown in the connection diagrams will rotate in the (CCW) direction.

2.3 MOTOR MOUNTED BLOWER

Check connection diagrams provided by the motor manufacturer before connecting the blower motor. The blower motor starter is not provided as a standard item with SECO supplied motor with blower.

2.4 MOTOR CONTROL MOUNTING

Pay particular attention to environmental conditions before installing the drive. Do not locate the control near furnaces, etc. (unless outside cooling air is provided to the control), in areas of high humidity and/or conductive atmosphere such as powdered metals.

2.5 CONNECTION INSTRUCTIONS

If you have not done so verify the HP rating, armature voltage, and field voltage of the motor to be used with this control. Refer to the connection diagrams in the print section of this manual for proper connections.

CAUTION: No terminal point in the control should be grounded except where such grounding is shown on the drawings or is approved by Seco Electronics. This instruction, however, does not apply to control cabinet, chassis and motor frame grounding, which we recommend be grounded.

Provide shielding for interconnecting signal wiring. Use Belden #8208 2-conductor and/or #8771 3-conductor shielded cable or their equivalents. Shielded Cable should be used for connecting such devices as speed and jog pots, tachometers, speed indicators, and ammeters, and other devices in the system reference and feedback circuitry. The shield should be connected to one point only, at control common terminal point. The other end of the shield should be taped off by itself. **DO NOT RUN SIGNAL WIRING IN CONDUIT WITH ANY POWER WIRING.**

2.5.1 CIRCUIT PROTECTION

Adequate circuit protection must be provided per state and local electrical codes. Model L400 controls have motor protection fuses in the armature circuit. See section 8.0 for fusing information.

2.5.2 ARMATURE FEEDBACK OR TACHOMETER FEEDBACK

To convert from armature feedback to tachometer feedback it is necessary only to connect the proper tachometer to the tachometer input terminals and the drive will operate in the tachometer feedback mode.

3.0 START-UP AND ADJUSTMENT PROCEDURE

3.1 START-UP PROCEDURE

Most problems in electro-mechanical systems occur during start-up. This procedure should be followed prior to applying power to the control.

1. Disconnect motor load:
Remove the coupling from the output shaft of the motor (or reducer) **Caution: Make sure shaft key is secured before running motor.** Several reasons for removing the load from the motor are given below:
 - a. Determines the motor direction without damaging the driven machine.
 - b. Prevents damage to the machine due to jams or mechanical misalignment if control should run at full speed.
 - c. Prevents nuisance fuse blowing or breaker tripping due to mechanical coupling or load problems.
 - d. Enables a check of motor vibration without damaging the load.
2. Set remote operator station speed adjust to zero:
3. Turn on AC power to control. If breaker trips or fuses blow at this point, refer to trouble shooting section of this manual.
4. At this point a multimeter can be used to check for proper line voltage. (208-250 VAC) Also check for proper field voltage to the particular motor being used.
5. Depress start button. The loop contactor should energize at this point. If it fails to "pull in" check the status indicator lights on the control board. If any of the lights are "on" refer to the trouble shooting section of this manual. Also check the control circuit fuse F1, on the control board. (See Fig. 3.1)
6. Increase speed adjust potentiometer setting to 20: Check motor, at this point the motor should be running at approximately 200 RPM. If the motor is not running check armature connections and armature voltage.

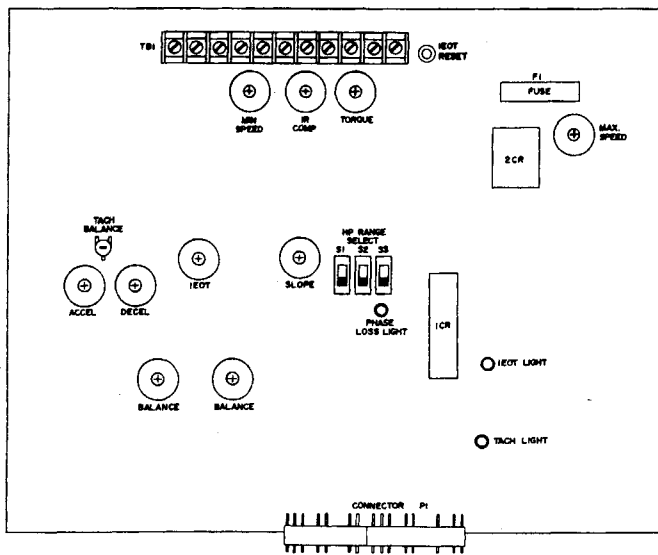


Figure 3.1

7. Increase speed adjust potentiometer setting to 100: Motor should run at full speed. If not, consult the trouble shooting section of this manual.
8. Return speed adjust setting to zero:
9. Push stop button: If control functions properly to this point, the load can now be connected and adjustments can be made.

3.2 DESCRIPTION OF ADJUSTMENTS

The controls on the control board may be adjusted as follows:

- A. **MINIMUM SPEED:** The minimum speed adjustment is a means to adjust the lowest output motor shaft speed when the speed adjust potentiometer is set to zero. Clockwise rotation of this adjustment increases the output speed.
- B. **MAXIMUM SPEED:** The Maximum speed adjustment is a means to adjust the highest motor shaft speed when the speed adjust potentiometer is set to 100. Clockwise rotation of this adjustment increases the output speed.
- C. **ACCELERATION:** The accel adjustment is used to change the accel rate of the motor from zero speed to set speed along a linear ramp. Clockwise adjustment increases the time from a minimum of 3 sec. to a maximum of 40 sec.
- D. **DECELERATION:** The Deceleration adjustment is used to change the deceleration rate of the motor from set speed to zero speed along a linear ramp. Clockwise adjustment increases the time from a min. of 3 sec to max. 40 sec.
- E. **TORQUE:** This control sets the maximum torque (armature current) supplied to the motor. Clockwise adjustment of this control to maximum will increase the limit to approximately 150% of rated value. Counterclockwise adjustment to minimum will reduce the limit to cause

the motor to stall (with a maximum slope setting.). For take-up operation adjust torque for correct tension at minimum roll diameter. Adjust slope for correct roll tension at maximum roll diameter.

- F. **SLOPE:** Used in conjunction with torque-decreasing speed characteristic above a fixed torque limit. (See Fig. 1.1) Increasing this control clockwise increases the slope setting to maximum (vertical line). Adjusting the torque setting moves the entire curve. Adjusting the slope setting changes the stall point only.
- G. **IR COMPENSATION:** The IR drop compensation adjustment provides a means to adjust the armature current feedback. This feedback is used to compensate for motor losses and to obtain flat load regulation. Clockwise rotation of this control increases the feedback if the feedback is too low, the motor speed decreases as the load increases. If the feedback is too high, the motor speed increases as the motor load increases. If the feedback is excessive, the system becomes unstable and pulsations may result.

In tachometer feedback mode the IR drop compensation is not required and the IR drop compensation adjustment is automatically disabled internally.
- H. **STATUS INDICATORS:** This control has three red status indicators. These indicators are LED's (light emitting diodes) designed to last the life of the control. They are designed to be viewed straight-on due to the type of lens construction.

1. **IEOT (Instantaneous Electronics Over-current Trip)**
This light will come on when the control has seen a fast high current pulse. The control will shut down and cannot be restarted until the reset button is depressed.
2. **PHASE:** This light will come on when two of the AC line phases are reversed or when a phase is missing (phase loss). The control will not start until this condition is corrected.

5.0 TROUBLE SHOOTING PROCEDURE

Fast, accurate, and complete repair is always preceded by a complete analysis of the problem. Read the trouble shooting procedure before attempting to repair the control. SECO controls have been factory tested before shipping. The problems that occur can be defined in two categories; start-up problems and problems that occur after the control has been operational for some time.

Start-up problems encountered are usually the result of improper interconnection wiring, handling damage, or load problems. CAREFULLY RECHECK all interconnection wiring, if difficulty is encountered on start-up. If this is not the problem, check for any apparent physical damage before proceeding to the trouble shooting charts.

CAUTION: Turn off AC power before touching or removing parts from this control.

5.1 VOLTAGE READINGS

A. POWER TERMINALS

<u>Terminals</u>	<u>Function</u>	<u>Voltage</u>
L1-to-L2	AC input phase 1	230 VAC
L2-to-L3	AC input phase 2	230 VAC
L1-to-L3	AC input phase 3	230 VAC
TB2-1-to-TB2-2	Field Voltage	150 VDC
TB2-3-to-TB2-4	Field Voltage	200 VDC
TB2-1-to-TB2-3	Field Voltage	240 VDC
A1-to-A2	Armature Voltage	0-240 VDC

B. SIGNAL TERMINALS

<u>Terminals</u>	<u>Function</u>	<u>Voltage</u>
TB1-10-to-TB2-8	AC Control Voltage	120 VAC
TB1-to-TB1-7	Reference Voltage	6 VDC
TB1-5-to-TB1-6	Potentiometer Voltage	0-5 VDC
TB1-2-to-TB1-3	Tachometer input Voltage	12.25 VDC at 1750 RPM

5.2 TROUBLE SHOOTING CHECK LIST

5.2.1 CONTROL WILL NOT START

A. Loop contactor will not energize.

1. Check AC input drive L1, L2, L3
2. Check status indicator lights on the control card, if any of these are on refer to list below.

A. PHASE LOSS/SEQUENCE: If this light is on, de-energize the AC input voltage to the control. Interchange input AC power lines to L1 and L2 to reverse the phase. Energize main power. The light should now be out.

B. IEOT TRIPPED: If this light is on push the IEOT reset button on the control card to turn off the light. Check motor load for a mechanical jam. Restart drive with start push button.

3. Check control circuit voltage (120 VAC) between TB1-10 and TB2-8

4. Check for blown control circuit fuse (F1) on control board. (See Fig. 3.1)

5.2.2 CONTROL BLOWS LINE FUSING

Disconnect both motor armature and motor field. Determine if the problem is in the power bridge. Check for a shorted SCR power diode or field diode bridge. If SCR's and diodes appear to be good, check for grounds on the speed pot wiring or tachometer wiring. Shorts to ground can cause damage to the speed pot and, or the printed circuit control board, which may require replacement. If no faults are found and control continues to blow fuses, consult factory.

5.2.3 CONTROL BLOWS ARMATURE FUSE

Check for fault conditions external to the control, wiring to the motor or the motor. Remove motor armature leads at the control and check for shorts or low resistance to ground (motor frame).

With motor disconnected start control and check for proper operation (vary speed pot from zero to full on and check armature voltage). If no defects have been found at this point, an overload condition exists. Check for system overload such as, jam-up, defective reducer, rating of drive, etc.

5.2.4 CONTROL FUSE BLOWS

Check for overloads in excess of 2 amps in control circuits.

5.2.5 LOOP CONTACTOR ENERGIZES, MOTOR WILL NOT RUN

Remove AC power, check for blown armature fuse. Check wiring to motor and motor leads for shorts to ground. Check speed pot wiring for reversed pot leads. Check torque limit pot setting and check motor for overload.

5.2.6 MOTOR RUNS FULL SPEED WITH NO CONTROL

Check speed pot wiring for reversed pot leads. Check minimum speed pot for continuity. Check Printed circuit card for blown paths. Remove AC power and check SCR's. If no defects have been found at this point, the trouble is a defective component on the printed circuit board; consult factory.

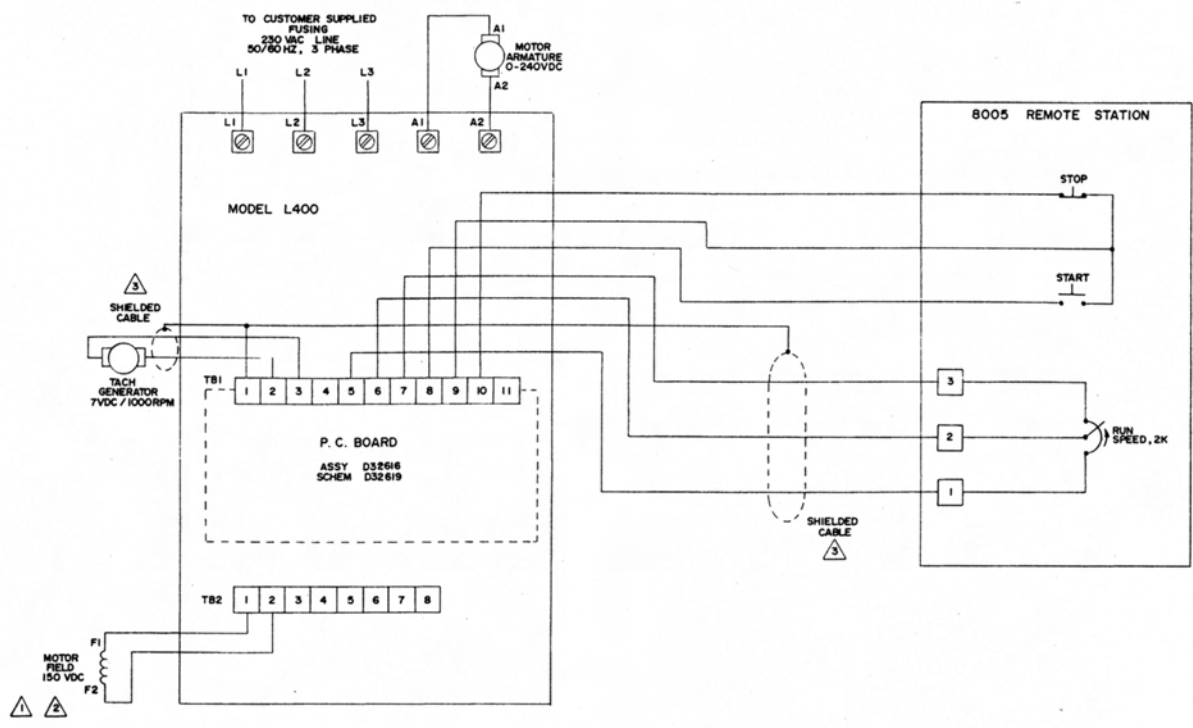
5.2.7 MOTOR PULSATES OR HUNTS

Turn IR Comp to zero. Check for proper connection of motor stabilized shunt winding. (S1 and S2 leads). Check for electrical noise pickup on tachometer feedback wires or reference circuits.

5.2.8 MOTOR WILL NOT MAINTAIN SPEED UNDER LOAD

Determine if control is overloaded by measuring motor armature current. Check setting of torque limit potentiometer and slope potentiometer. Check setting of HP Range switches. Be sure these correspond to the rating of your motor.

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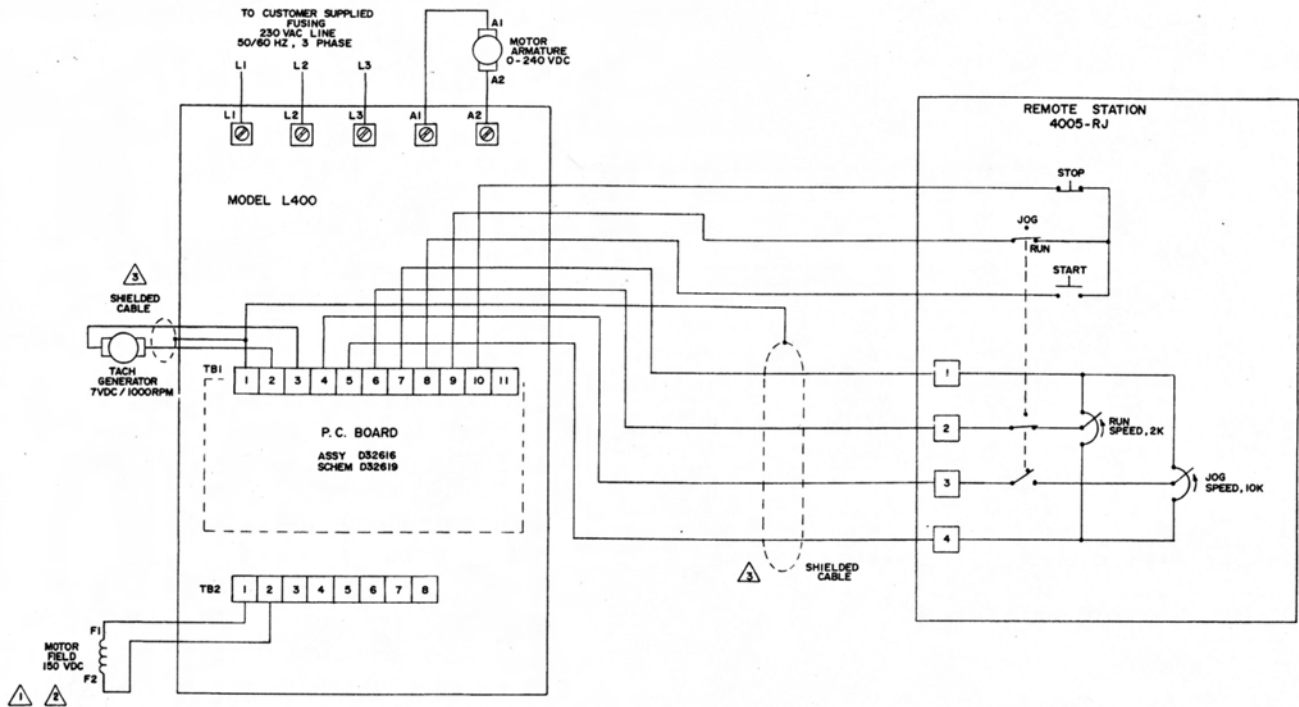
- ⚠ DO NOT RUN TACH WIRES & POT WIRES IN SAME SHIELDED CABLE. ALL SIGNAL WIRING (TACH LEADS & POT LEADS) MUST BE RUN IN CONDUIT SEPARATE FROM ALL POWER WIRING. CONNECT SHIELD AT CONTROL & INSULATE OTHER END.
 ⚠ FOR 200V FIELD OPERATION, CONNECT F1 TO TB2-4 AND F2 TO TB2-3.
 ⚠ FOR 240V FIELD OPERATION, CONNECT F1 TO TB2-1 AND F2 TO TB2-3.

NOTES

THIS DRAWING CONTAINS INFORMATION PROPRIETARY TO BECO ELECTRONICS CORP. ANY REPRODUCTIONS, DISCLOSURE OR USE OF THIS DRAWING IS EXPRESSLY PROHIBITED EXCEPT AS BECO ELECTRONICS CORP. MAY AGREE TO IN WRITING.

QTY / ASSY	PART NUMBER	DESCRIPTION
1	8005	REMOTE STATION
1	P.C. BOARD	ASSY D32616 SCHEM D32619
1	TACH GENERATOR	7VDC / 1000RPM
1	MOTOR FIELD	150 VDC
1	MOTOR ARMATURE	0-240VDC

REV	DATE	APPROVED
1	4-18-78	H.E.B.



- ⚠ DO NOT RUN TACH WIRES & POT WIRES IN SAME SHIELDED CABLE. ALL SIGNAL WIRING (TACH LEADS & POT LEADS) MUST BE RUN IN CONDUIT SEPARATE FROM ALL POWER WIRING. CONNECT SHIELD AT CONTROL & INSULATE OTHER END.
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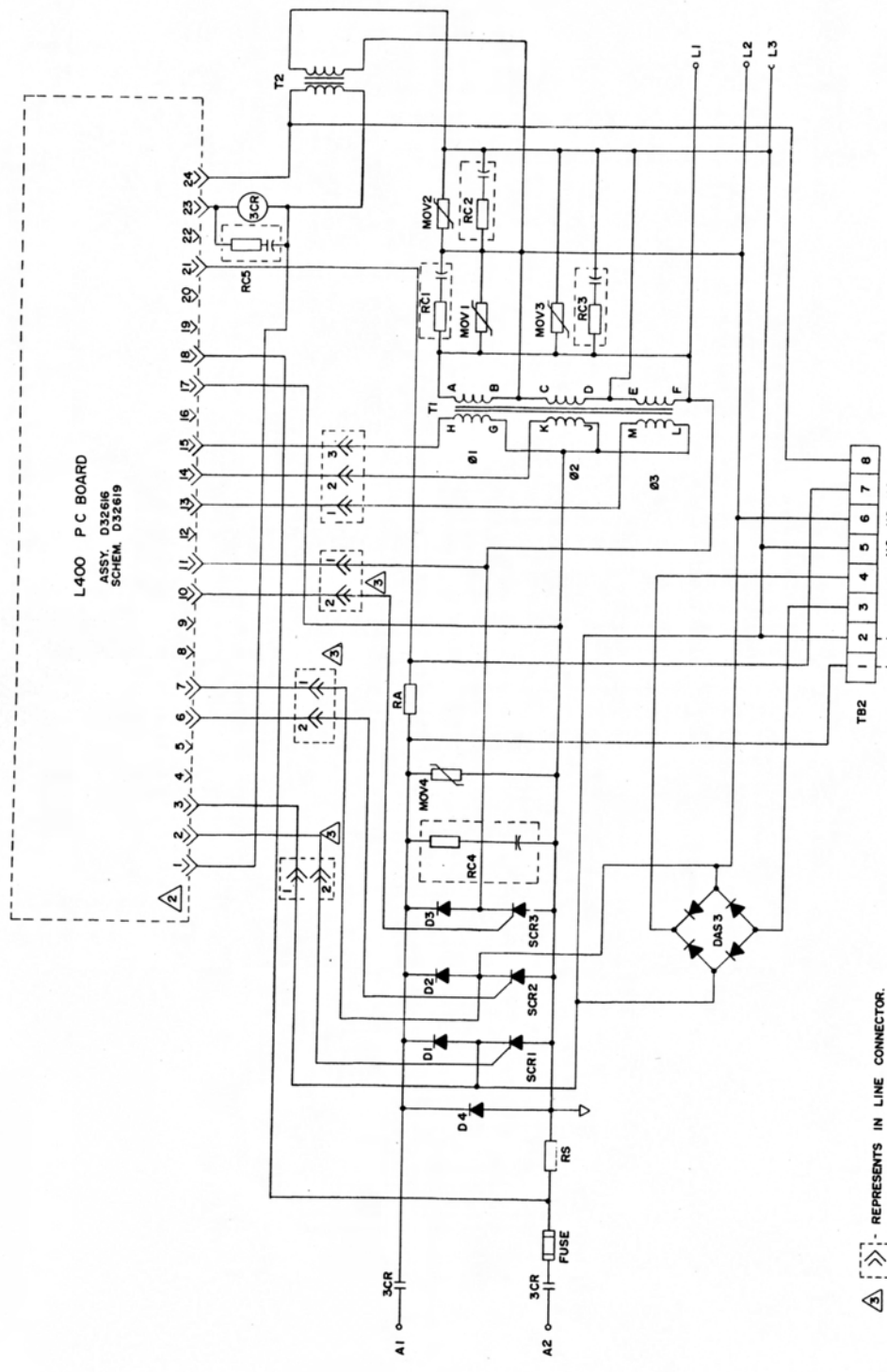
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QTY / ASSY	PART NUMBER	DESCRIPTION
1	4005-RJ	REMOTE STATION
1	P.C. BOARD	ASSY D32616 SCHEM D32619
1	TACH GENERATOR	7VDC / 1000RPM
1	MOTOR FIELD	150 VDC
1	MOTOR ARMATURE	0-240VDC

REV	DATE	DESCRIPTION	APPROVED
1	7-20-73	E.C.O. 578	266 E
2	11-18-80	REVISED P.C. BOARD # 1	
REVISIONS			
DATE	DESCRIPTION	APPROVED	
7-20-73	E.C.O. 578	266 E	
11-18-80	REVISED P.C. BOARD # 1		

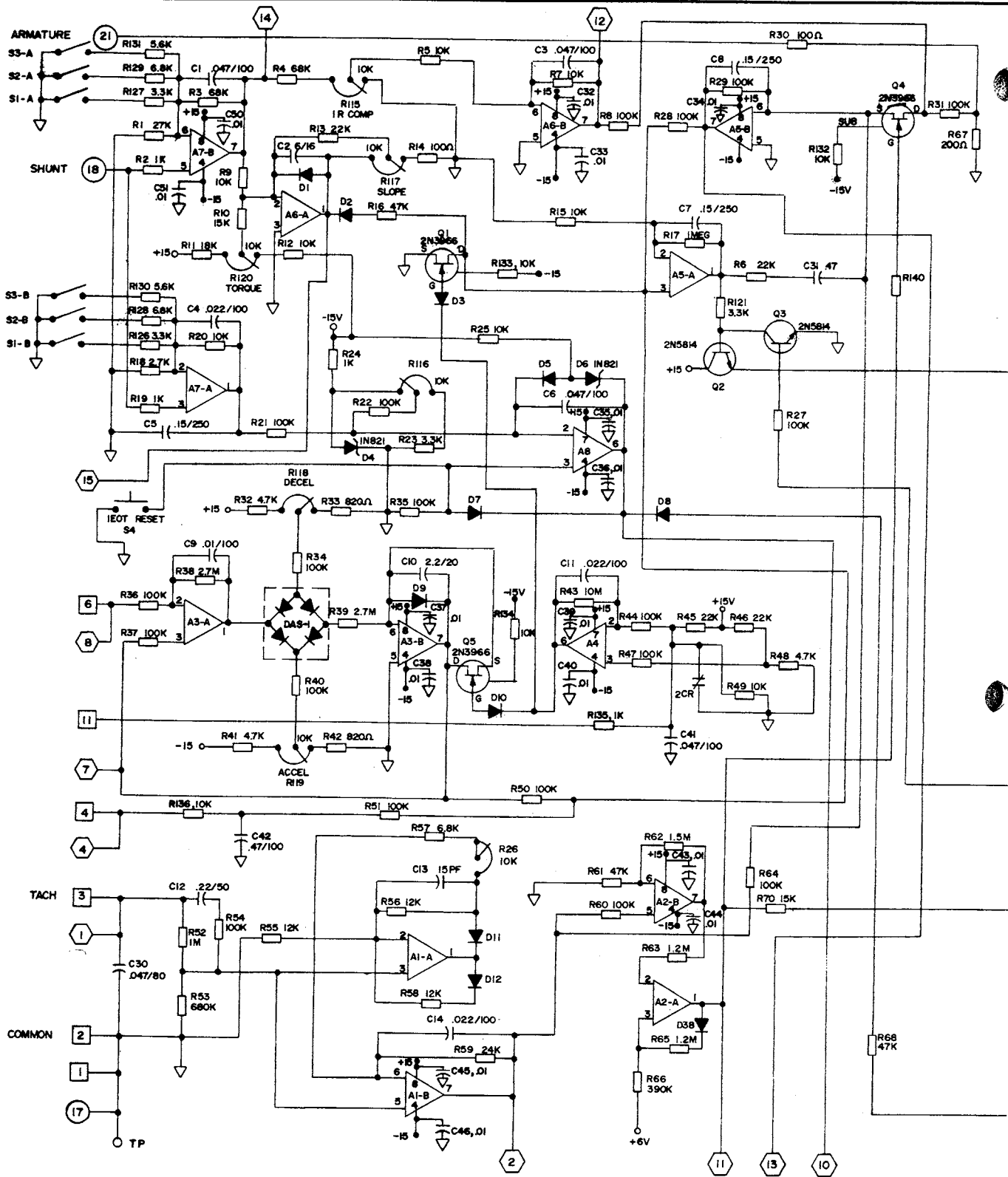
L400 P C BOARD
 ASSY. D32616
 SCHEM. D32619



- △ - REPRESENTS IN LINE CONNECTOR.
- △ - REPRESENTS MOLEX 24 PIN CONNECTOR.
- △ CONNECTION SHOWN IS FOR 150V FIELD. FOR 200V FIELD, CONNECT F1 TO TB2-4 & F2 TO TB2-3. FOR 240V FIELD, CONNECT F1 TO TB2-1 & F2 TO TB2-3.

NOTES

QTY / ASSY	PART NUMBER	DESCRIPTION
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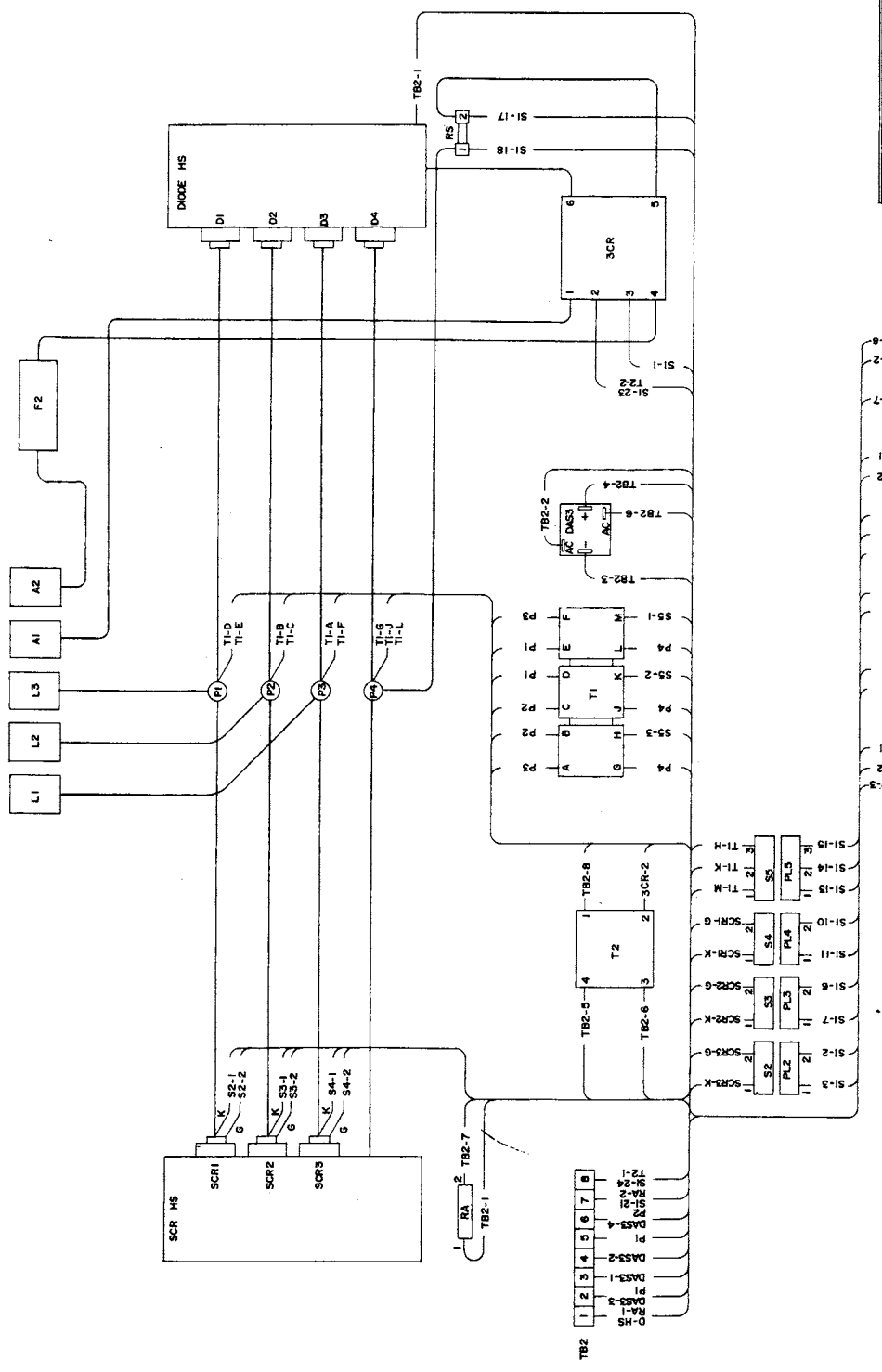
- 7. REFERENCE ASSY. D32616
- 6. ○ REPRESENTS CONNECTIONS TO MOLEX TEST CONNECTOR (15 POS)
- 5. ○ REPRESENTS CONNECTIONS TO MOLEX CONNECTOR (24 POS)
- 4. □ REPRESENTS CONNECTIONS TO TERMINAL STRIP.
- 3. → ARROWS ON POTS INDICATE CW ROTATION.
- 2. ALL CAPACITOR VALUES IN MFDS/WVDC.
- 1. ALL RESISTORS 0.5 WATT, 10%.

NOTES UNLESS OTHERWISE SPECIFIED

CONTROL BOARD PARTS LIST

R140	1	86	PRE1033-68	RESISTOR, 22M, 1/2 W
C15, 47, 48, 49	4	85	PCA2031-01	CAPACITOR, 2.2/50
R137, 138, 139	3	84	PRE1031-41	RESISTOR, 120Ω
L1	1	83	HLA1002-04	LABEL, MIN SPEED
L2	1	82	HLA1002-03	LABEL, MAX SPEED
L3	1	81	HLA1002-10	LABEL, ACCEL
L4	1	80	HLA1002-11	LABEL, DECEL
L5	1	79	HLA1002-12	LABEL, IEOT
L6	1	78	HLA1002-09	LABEL, SLOPE
L7	1	77	HLA1002-08	LABEL, TORQUE
L8	1	76	HLA1002-07	LABEL, IR COMP
L9	2	75	HLA1002-06	LABEL, BALANCE
SP1, 2, 3	3	74	HFA4015-00	SPACER
R26	1	72	APT1022-01	POTENTIOMETER, 10K
R115, 116, 117, 118, 119, 120, 122, 123	8	71	APT1007-03	POTENTIOMETER, 10K
R124, 125	2	70	APT1007-02	POTENTIOMETER, 2K
R43	1	69	PRE1034-60	RESISTOR, 10 MEG
R38, 39	2	68	PRE1034-46	RESISTOR, 2.7 MEG
R62	1	67	PRE1034-40	RESISTOR, 1.5 MEG
R63, 65	2	66	PRE1034-38	RESISTOR, 1.2 MEG
R17, 52	2	65	PRE1034-36	RESISTOR, 1 MEG
R53	1	64	PRE1034-32	RESISTOR, 680K
R66	1	63	PRE1034-26	RESISTOR, 390K
R8, 21, 22, 27, 28, 29, 31, 34, 35, 36, 37, 40, 44, 47, 50, 51, 54, 60, 64, 75, 84	21	62	PRE1034-12	RESISTOR, 100K
R3, 4, 69	3	61	PRE1034-08	RESISTOR, 68K
R83, 16, 61, 68, 72, 77, 94, 96, 102, 105, 111, 114	12	60	PRE1034-04	RESISTOR, 47K
R79	1	59	PRE1034-02	RESISTOR, 39K
R92, 100, 108	3	58	PRE1031-97	RESISTOR, 27K
R59	1	57	PRE1031-96	RESISTOR, 24K
R143, 145, 146, 6, 45, 46, 13	7	56	PRE1031-95	RESISTOR, 22K
R11	1	55	PRE1031-93	RESISTOR, 18K
R10, 70, 74, 84, 93, 95, 101, 103, 110, 112	10	54	PRE1031-91	RESISTOR, 15K
R55, 56, 58	3	53	PRE1031-89	RESISTOR, 12K
R78, 82, 142, 144, 147, 5, 7, 9, 12, 15, 20, 25, 49, 71, 73, 132, 133, 134, 136	19	52	PRE1031-87	RESISTOR, 10K
R57, 128, 129	3	51	PRE1031-83	RESISTOR, 6.8K
R85, 130, 131	3	50	PRE1031-81	RESISTOR, 5.6K
R32, 41, 48, 76, 80, 81	6	49	PRE1031-79	RESISTOR, 4.7K
R23, 121, 126, 127	4	48	PRE1031-75	RESISTOR, 3.3K
R141, 1, 18	3	47	PRE1031-73	RESISTOR, 2.7K
R97, 104, 113	3	46	PRE1031-71	RESISTOR, 2.2K
R33, 42	2	45	PRE1031-61	RESISTOR, 820Ω
R98, 106, 109	3	44	PRE1031-67	RESISTOR, 1.5K
R135, R2, 19, 24, 87, 88, 90, 91, 99, 107	11	43	PRE1031-63	RESISTOR, 1K
R67	1	42	PRE1031-46	RESISTOR, 200Ω
R14, 50	2	41	PRE1031-39	RESISTOR, 100Ω
R86, 89	2	40	PRE1003-18	RESISTOR, 56Ω, 1W
C2	1	39	PCA2013-01	CAPACITOR, 5/15
C20, 21	2	38	PCA2010-05	CAPACITOR, 10/64
C10	1	37	PCA2012-00	CAPACITOR, 2.2/20
C17, 18, 19	3	35	PCA2008-05	CAPACITOR, 470/25
C5, 7, 8, 22, 23	5	34	PCA1017-00	CAPACITOR, 15/200
C13	1	33	PCA1012-00	CAPACITOR, 15 pf
C31, 42	2	31	PCA1010-02	CAPACITOR, .47/50
C51, 50, 9, 32, 33, 34, 35, 36, 37, 38, 39, 40, 43, 44, 45, 46	16	29	PCA1005-05	CAPACITOR, .01/100
C30, C41, C1, 3, 6	5	28	PCA1005-04	CAPACITOR, .047/100
C16, 52, 53, 12, C24, 25, 26, 27, 28, 29	10	27	PCA1005-02	CAPACITOR, .22/100
C4, 11, 14	3	26	PCA1005-01	CAPACITOR, .022/100
RC1	1	25	PCA1028-00	SNUBBER
D26, 27	2	24	PDI3001-00	DIODE, IN4744
D13, 16, 19	3	23	PDI4002-00	DIODE, LED
D4, 6, 28	3	22	PDI3002-00	DIODE, IN321
D1-3, 5, 7-12, 14, 17, 18, 20-25, 29-41	32	21	PDI1006-00	DIODE, IN4004
Q16, 20, 24	3	20	ATR4001-00	TRANSISTOR, 2N6027
Q14	1	19	ATR2001-00	TRANSISTOR, 40319
Q13	1	18	ATR1001-00	TRANSISTOR, 2N2102
Q2, 3, 6, 7, 8, 9, 10, 11, 12, 15, 17, 18, 19, 21, 22, 23, 25, 26	18	17	ATR1009-00	TRANSISTOR, 2N5814
Q1, 4, 5	3	16	ATR3003-00	TRANSISTOR, 2N3966
F1	1	15	PFU1004-05	FUSE
FC1, 2	2	14	PFU2007-00	FUSE CLIP
TB1	1	13	HWA2012-11	TERMINAL STRIP, 11 POS.
M2, 3	2	12	HWA1105-00	CONNECTOR, 12 POS.
S4	1	11	ASW2014-00	SWITCH
S1, 2, 3	3	10	ASW1042-00	SWITCH
DAS1, 2	2	9	PDI5001-00	BRIDGE, KBP-02
T1, 2, 3	3	7	PTR2001-00	TRANSFORMER, 351P13
SC1, 2, 3, 4, 5, 6, 7, 8	8	6	HWA1116-00	IC SOCKET
A4, 8	2	5	AIC1006-00	OP AMP, 741, SINGLE
A1, 2, 3, 5, 6, 7	6	4	AIC1003-00	OP AMP, 741, DUAL
2CR	1	3	ARE2009-00	RELAY, 120 VAC
1CR	1	2	ARE1001-00	RELAY, 24CG1A
-	1	1	PCBD31641D	P.C. BOARD

FORM 101	REVISION	DATE	APPROVAL
A	CHANGE - 2nd Party	7-28-77	
B	REVISION 1 - 1st Party	4-18-80	YCB

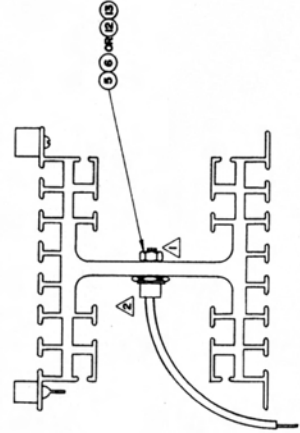
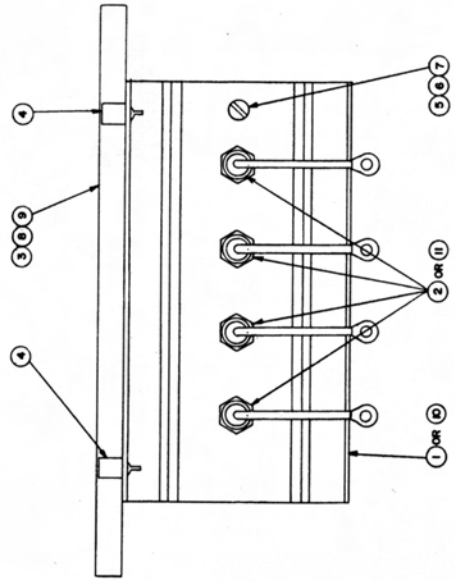


QTY / ASST	PART NUMBER	DESCRIPTION
1	1-1-1	SECO ELECTRONICS COMP. S.A.A.
1	1-1-2	SECO ELECTRONICS COMP. S.A.A.
1	1-1-3	SECO ELECTRONICS COMP. S.A.A.
1	1-1-4	SECO ELECTRONICS COMP. S.A.A.
1	1-1-5	SECO ELECTRONICS COMP. S.A.A.
1	1-1-6	SECO ELECTRONICS COMP. S.A.A.
1	1-1-7	SECO ELECTRONICS COMP. S.A.A.
1	1-1-8	SECO ELECTRONICS COMP. S.A.A.
1	1-1-9	SECO ELECTRONICS COMP. S.A.A.
1	1-1-10	SECO ELECTRONICS COMP. S.A.A.
1	1-1-11	SECO ELECTRONICS COMP. S.A.A.
1	1-1-12	SECO ELECTRONICS COMP. S.A.A.
1	1-1-13	SECO ELECTRONICS COMP. S.A.A.
1	1-1-14	SECO ELECTRONICS COMP. S.A.A.
1	1-1-15	SECO ELECTRONICS COMP. S.A.A.
1	1-1-16	SECO ELECTRONICS COMP. S.A.A.
1	1-1-17	SECO ELECTRONICS COMP. S.A.A.
1	1-1-18	SECO ELECTRONICS COMP. S.A.A.
1	1-1-19	SECO ELECTRONICS COMP. S.A.A.
1	1-1-20	SECO ELECTRONICS COMP. S.A.A.
1	1-1-21	SECO ELECTRONICS COMP. S.A.A.
1	1-1-22	SECO ELECTRONICS COMP. S.A.A.
1	1-1-23	SECO ELECTRONICS COMP. S.A.A.
1	1-1-24	SECO ELECTRONICS COMP. S.A.A.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
SI	SI-1	SI-2	SI-3	SI-4	SI-5	SI-6	SI-7	SI-8	SI-9	SI-10	SI-11	SI-12	SI-13	SI-14	SI-15	SI-16	SI-17	SI-18	SI-19	SI-20	SI-21	SI-22	SI-23	SI-24

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REVISIONS
 DATE 3-17-78
 APPROVED
 L425



APPLY SILICONE COMPOUND TO MOUNTING SURFACE OF EACH DIODE.
 TORQUE ALL DIODES PER ENGINEERING SPECIFICATION.

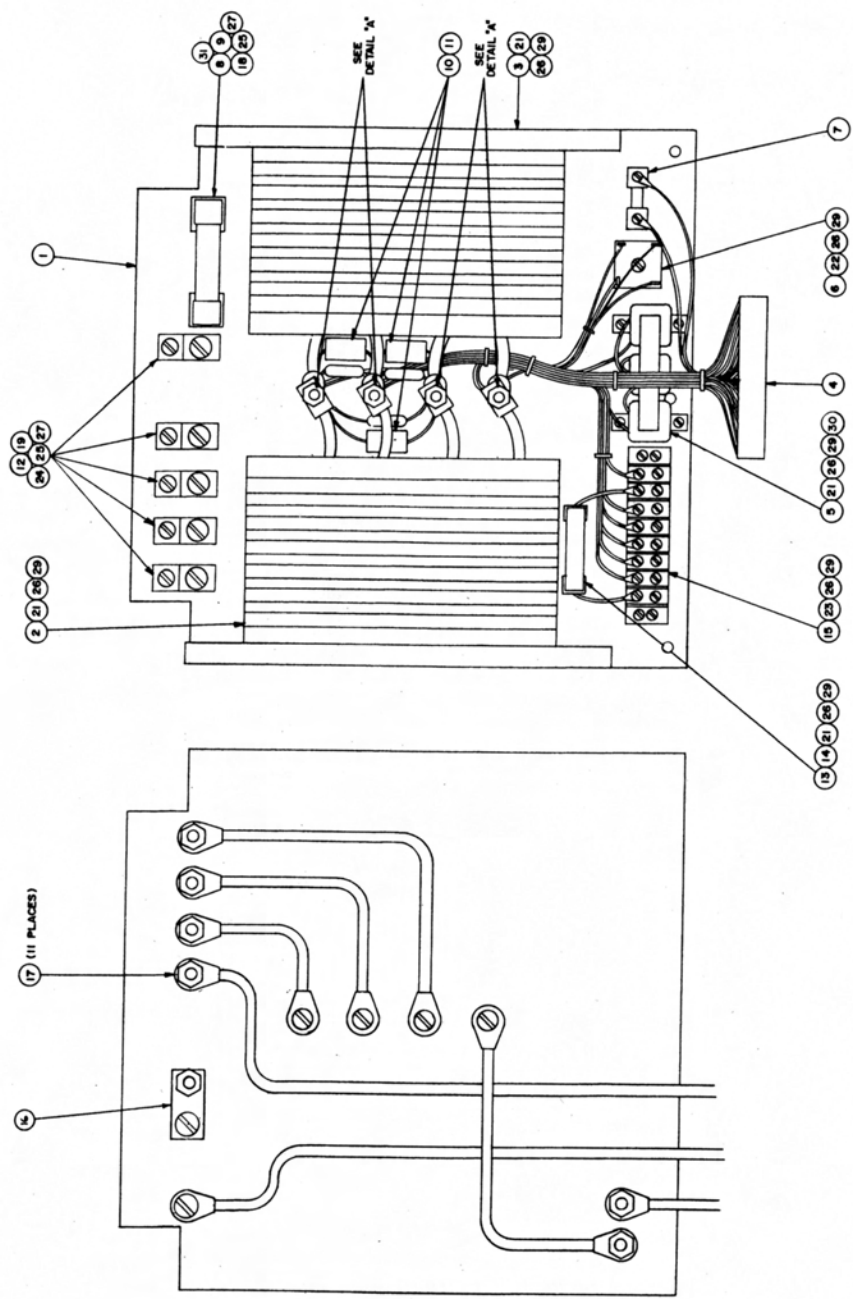
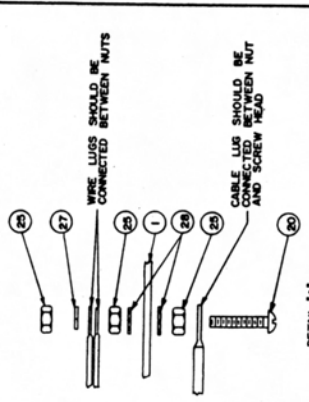
- NOTES -

QTY / ASSY	PART NUMBER	DESCRIPTION
4	13	WASHER, LOCK, 3/8
4	12	NUT, HEX, 3/8
1	11	POST, 2004-00
1	10	HEAT SINK, DIODE
2	9	WASHER, EXT. STAR, NO. 8
2	8	SCREW, 8-32 X 3/8
1	7	SCREW, HEX. HD., 1/4-20 X 3/4
1	6	WASHER, LOCK, 1/4
1	5	NUT, HEX, 1/4
1	4	STANDOFF, RUBBER
1	3	HEAT SINK, DIODE
1	2	DIODE, 70A, 600V BAR
1	1	HEAT SINK, DIODE

SECO ELECTRONICS CORP. U.S.A.
 LANSING, MICH.
 DATE 7-13-78
 DRAWN BY
 CHECKED BY
 SCALE 1:1
 SHEET NO. D 031785-A
 SHEET

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REV	DATE	DESCRIPTION	BY	CHKD
1	11-15-76	REVISED TO ADD PARTS TO BE ORDERED	W. J. W.	W. J. W.
2	11-15-76	REVISED TO ADD PARTS TO BE ORDERED	W. J. W.	W. J. W.
3	11-15-76	REVISED TO ADD PARTS TO BE ORDERED	W. J. W.	W. J. W.
4	11-15-76	REVISED TO ADD PARTS TO BE ORDERED	W. J. W.	W. J. W.



QTY	PART NUMBER	DESCRIPTION
1	31	(PART 2)
1	30	TRANSFORMER SUB-ASSY.
1	19	WASHER, LOCK, NO. 8
1	8	WASHER, EXT. STAR, 1/4"
1	11	NUT, HEX, NO. 8-32
1	19	NUT, HEX, NO. 8-32
1	5	SCREW, PAN HD, NO. 8-32 X 5/8"
1	4	SCREW, PAN HD, NO. 8-32 X 3/4"
1	14	SCREW, PAN HD, NO. 8-32 X 3/4"
1	4	SCREW, PAN HD, NO. 8-32 X 3/4"
1	5	SCREW, HEX HD, 1/4-20 X 1 1/4"
1	2	SCREW, HEX HD, 1/4-20 X 3/4"
1	11	SCREW, HEX HD, 1/4-20 X 5/8"
1	16	LUG
1	15	BUSS BAR
1	14	TERMINAL STRIP, 8 POS.
1	13	FUSE CLIP
1	12	RESISTOR, 10K, 10W
1	11	LUGS, LINE 8 ARM
1	10	SNUBBER
1	9	MOV
1	8	FUSE CLIP
1	7	FUSE, 60 AMP
1	6	METER SHUNT, 30 AMP
1	5	BRIDGE
1	4	TRANSFORMER SUB-ASSY.
1	3	WIRE HARNESS ASSY.
1	2	DIODE HEAT SINK ASSY.
1	1	SCR HEAT SINK ASSY.
1	1	SUB-CHASSIS

REV	DATE	DESCRIPTION	BY	CHKD
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4	11-15-76	REVISED TO ADD PARTS TO BE ORDERED	W. J. W.	W. J. W.

TABLE 1	TABLE 2
00 L400-59339	52376 60A 42A
01 L400-59339	52377 50A 35A
02 52376, 52377	52378 40A 17A
	52379 40A 21A

THE DRAWING CONTAINS INFORMATION PROPRIETARY TO SICO ELECTRONICS CORP. ANY REPRODUCTION, INCLUDING OR LACK THEREOF, WITHOUT THE WRITTEN PERMISSION OF SICO ELECTRONICS CORP. MAY BE SUBJECT TO PROSECUTION.

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4	11-15-76	REVISED TO ADD PARTS TO BE ORDERED	W. J. W.	W. J. W.

7.0 RECOMMENED SPARE PARTS

Qty.	Description	Seco Part No.
1	Control Fuse – F1	PFU 1004-05
3	SCR Assy – SCR1, SCR2, SCR3	ATY 1030
4	Diode – PD1, PD2, PD3, PD4	PDI 2017
1	Control Board	D32616

8.0 FUSE DATA

8.1 RECOMMENDED LINE FUSES

H.P.	Fuse Rating	VENDOR PART NUMBER			Seco Part No.
		Bussman	International Rectifier	Chase Shawmut	
5	60A 250V	KAX60	SF25X60	A25X60	PFU 1002-06
7½	60A 250V	KAX60	SF25X60	A25X60	PFU 1002-06
10	60A 250V	KAX60	SF25X60	A25X60	PFU 1002-06
15	100A 250V	KAX100	SF25X100	A25X100	PFU 1002-09